BIOCHEMISTRY

CHANGES OF WATER AND NITROGEN CONTENT OF "TRASI" DURING COMMERCIAL PREPARATION AND STORAGE.

BY

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INTRODUCTION

In general, the average Indonesian diet contains a low amount of protein, especially animal protein. Under these conditions, one of the most important sources of protein is fish, which is a common ingredient of the rice eater's diet. It is eaten fresh, dried, salted or in the form of a paste or a sauce. However, the relatively high price of the fresh fish, the limited stupply of the fish products, their poor keeping quality as well as inadequate marketing systems have acted as obstacles to a greater fish consumption. A fish product, which is extensively used in Indonesia, is the fish paste *(trasi ikan)* and shrimp paste *(trasi udang)*. The unit amount of *trasi* consumed in the individual Indonesian diet is small; nevertheless, it acts as a flavoring agent for a large number of foods. Therefore with a large population, the total consumption of *trasi* in Inlonesia is large. Although the exact amount consumed is not known, an idea of the extent of use of *trasi* can be obtained from the data reported by Markus *(cit. Van Veen, 1953)*. According to him, 17.5 million kg. of *trasi* was exported in 1928 from Bagan Siapi-api, mainly to Java. In order to supply more animal protein, possibilities were discussed during the Fisheries Meeting held in Baguio in 1948, of ways to increase fish production in Southeast Asia *(Van Veen, 1953)*. The conclusion was drawn that increased fish production would be of limited value unless efficient methods of preservation and distribution were adopted. This would allow more fish to be made available to the large polulation living beyond the fishing centers. At the present time, these inland population centers have only a limited fish supply owing to the hot and damp climate, which promotes spoilage. The modern methods of fish preservation — canning, freezing and icing — are generally too expensive to produce a product within the financial means of the rice eater. Besides the price, the tastes of the rice eater differ from those of the American or European. Thus to more nearly suit the taste of the rice eater and to maintain a low price, the present Indonesian methods of preservation which include drying, drying and salting could probably better be modified rather than modern methods introduced.

To asses possible production or storage modification in *trasi,* studies are needed concerning the product and its change upon storage. Only a few references on the analysis of *trasi* could be found in literature, the first being that of Quintus Bosz *(1911)*. This analysis is presented in Table I.

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Table I.

Composition of *Trasi* (Modified Quintus Bosz, 1911)

NAME	Wet sample						Dry sample		
	Publication year	Prot.	Fat	Moisture	Nutritive value	Ash	Prot.	Fat	Nutritive value
I. *Trasi udang* *)	1903	28.50	3.05	41.01	164	24.86	48.31	5.17	278
II. Trasi	1903	38.25	2.88	50.98	217	11.87	78.00	5.88	443
III. Ibid	1906	41.69	3.65	45.62	238	10.93	76.66	6.71	437
IV. Ibid	—	38.84	3.40	—	—	12.36	—	—	—

The values presented in this table may be compared with those reported by Markus (Cit. Van Veen, 1953).

Markus found that *trasi udang* of Bagan Siapi-api contains 50 to 57% moisture, 15 to 20% salt and 27 to 30% solids (proteins, Ca salts, etc.). *Trasi ikan* contains 35 to 50% moisture, 20 to 45% protein and protein degradation products, 10 to 25% minerals (NaCl and Ca salts) and a small percentage of fatty substances. However, no study of the changes in water and nitrogen content of *trasi* during commercial preparation and storage has been reported. It is believed that such studies are neccessary preliminary to recommendations as to changes in present production or storage methods. Such changes could lead to lowered price and increased consumption of a protein rich product by the population.

This report may be divided into two types of studies. The amount of water and nitrogen present in *trasi* was determined during:

a. the preparation from the raw material and
b. storage.

*) *Trasi udang* is usually made from "*udang rebon*" (Mysis sp.), which is found in large amounts on the North coast of Java.

MATERIALS AND METHODS

Materials: *Trasi* is produced in Indonesia in several places especially on the North coast of Java and the East coast of Sumatra. We have observed the production in Pengarengan, where *trasi* is produced as a simple home industry and in Indramaju, where *trasi* is produced in larger quantities. Both places prepared *trasi udang* and *trasi ikan* (I). In case of *trasi udang* the manufacturers made a distinction between the types produced in the two seasons. *Trasi gonjean* (G) is made in the dry season *trasi kundulan* (K) in the wet season. As a flavoring agent the latter is more appreciated by "insiders" than the former. On the market however, both types are mixed and no differences are made. No distinction according to the seasons is made by the manufactures in *trasi ikan*, for this only a by-product.

The manufacturing of *trasi* proceeds as follows : In *trasi* G or I, produced in the dry season, the initial raw shrimp or fish is spread on large bamboo floors and dried for one day. Only in fishing centers, where several days are needed to reach the harbor, the raw material is incompletely preserved with a small amount of salt.

Otherwise no preserving substances are added to the starting material. After the first drying, impurities are removed (lobsters, crabs, etc.) and the mass is pounded in wooden mortars. This first pounded stage is then subjected to one or more additional dryings and poundings until a homogeneous paste — the *trasi* — is obtained. The final *trasi* is kneaded into various shapes and might be wrapped with dry banana leaves. *Trasi K* is prepared in the same way as G. However, because of lack of sunlight in the wet season, more time is needed to dry the shrimp. As a result of this slow drying process, a drip is formed which is drained away and is used for the production of other foods. Minor variations of the above preparation method are used from place to place. In Pengarengan the final *trasi* is obtained after two poundings. Sugar, dyestuff and sometimes salt are added during the first pounding process. In Indramaju the trasi is produced after three poundings. Here salt and sweet rice "pap" are added during the first pounding.

Studied on the changes in water and nitrogen content has been made with different samples of *trasi*. For the study during the preparation, samples were supplied by the manufactures in Pengarengan and Indramaju. The individual preparation stages were obtained early in the morning; were then placed in closed bottles and carried to Tjirebon. About two hours later, the moisture content was determined. The samples for the nitrogen (N) analysis were weighed, mixed with a digestion mixture containing concentrated H_2SO_4 and stored in bottles until returning to Bandung, where they were analyzed. The presence of concentrated H_2SO_4 prevented bacterial decomposition *(Jordan and Burrows, 1945)*, so that minimal changes in the N content was believed to occur. For the study of the changes in water and N content during storage we used two types (G and K) of freshly prepared trasi Indramaju and three other samples — exact age ,type and production place unknown — purchased from the local markets for Rp. 2.—, Rp. 6.— and Rp. 6.— and Rp. 8.— per ounce.

Methods : All samples were homogenized in a mortar and three aliquots were removed for analysis.

For the determination of the water content, approximately 2 — 5 grams of this homogenized mass was placed in a watch glass and dried in an oven at 100° C to 105° C for 15 min., until successive weighings show no further loss. The determination of the N content was done by the marco Kjeldahl method (Jacobs, 1938).

RESULTS AND DISCUSSION

A summary of the original data is presented in Tables II, III and IV.

I. Losses during the preparation of trasi

a. *Water content.* As may be seen from the data presented in Table II, the total water content decreases during the preparation of both *trasi* Pengarengan and Indramaju. In *trasi* Pengarengan all three types G, K and I showed a water loss of about 40% during the first production stage. In the second or final production stage in Pengarengan the water content was increased. The increase in water is largest for G when compared with K and I. This increase my result from the addition of water during the preparation of this final stagge. In *trasi* Indramaju type G and also showed a water loss of about 40% during the first production stage. However, the water loss of K during this first stage is much smaller (19.4%). In the second production stage of *trasi* Indramaju, and additional 10% is lost by G and I. The water loss of K during this second stage is much larger (31.6%). Only in Indramaju is there a third production stage, in which in G, K and the water content is increased. The water increased is here also largest for G when compared with K and I However, although the water content is unevenly distributed in the three types of *trasi* Pengarengan and Indramaju, the total loss during the preparation is approximately equal.

Table II.

Average Change of Water Content in *Trasi Udang* & *Trasi Ikan* during Comercial Preparation.

Sample	Initial	△ 1st pounded	△ 2nd pounded	△ End-product	△ Total H_2O
Trasi Pengarengan					
	2)	2)		2)	
Gonjean (Shrimp)	78.1±1.7	—45.1±2.9	—	+14.1±0.1	—31.0±0.1
Kundulan (Shrimp	77.6±1.3	—39.1±0.6	—	+ 6.6±0.3	—32.5±0.3
Ikan (Fish)	76.1±1.1	—42.9±2.2	—	+ 6.1±1.9	—36.8±0.3
Trasi Indramaju					
Gonjean (Shrimp)	78.7±1.8	—44.8±0.8	—10.6±0.5	+22.5±2.0	—32.9±0.8
Kundulan (Shrimp	78.4±1.0	—19.4±5.3	—31.6±3.3	+18.1±1.5	—33.0±2.0
Ikan (Fish) [3]	75.9±0.8	—39.9±2.2	— 9.0±0.3	+10.4±1.3	—39.5±0.9

NOTE :

1) Initial is the fresh material; △ 1st pounded and △ 2nd pounded is the difference between the initial and the intermediate stages of *trasi* preparation (see text) ; △ endproduct is the difference between the intermediate and the final stage of preparation (see text) ; △ total change is the difference between the fresh material and the final product.

2) A minus sign in front of a number indicates a loss, a positive indicates a gain in water. Plus and minus indicates the analytical variation in percent.

3) Average of 2 analysis, the rest are triplicate samples.

b. Nitrogen content. Triplicate analysis of three samples during the preparation of trasi in Pengarengan and Indramaju shows that in general, for the two groups of *trasi*, the N loss is greater in the first production or 1st pounded stage than in other stages. It was also observed that the N loss in this stage is for the Pengarengan group much smaller than for the Indramaju group.

This apparent N loss in the first stage may be caused by the addition of non-nitrogeneous flavoring substances to the starting material during the processing. In the other stages the N values are essentially all more or less constant, nevertheless all N values demonstrate a trend to be lower in the final than in the initial stages. In both groups of *trasi* this apparent N loss is largest for K when compared with G and I. The N content based on drymass in the final *trasi* varied in our analysis between 8.05 — 0.48% and 10.22 — 0.81%.

Based upon the water and N content taken together during the *trasi* preparation, it does not appear meaningful to pound the fresh starting material two or three times with a lapse of one day.

Particularly for G and I, one single drying over a two or three day period could be sufficient. At the end of this period, the dried mass could be pounded directly to the fine endproduct, during which flavoring substances and water could be added. The advantage of drying over a longer period followed by one single pounding would be a decrease of the amount of wasted material. Also the amount of labour and time needed for the *trasi* preparation would probably be reduced. If we assume that during the *trasi* preparation every pounding needs an average of 10 min., then for trasi Pengarengan the total preparation time is 2 × 10 min. or 20 min. an for *trasi* Indramaju 3 × 10 min. or 30 min. In the proposed method a single pouding of about 15 min. would probably be sufficient. For every mortarful of material, this would mean a decrease in total commercial production time of 5 min. for *trasi* Pengarengan and 15 min. for *trasi* Indramaju. If a wooden mortar can contain about 2.5 kg of shrimp of fish and a daily everage of 25 kg is pounded, then the proposed method would probably mean a saving of 50 min./day for the preparation of *trasi* Pengarengan and 150 min./day for *trasi* Indramaju. In a month of 25 labor days, of 7hrs./day, this would probably save about 3 days for the preparation of *trasi* Pengarengan and 9 days for *trasi* Indramaju.

This proposed method of one drying over a longer period followed by one single pounding could probably also be used for the preparation of *trasi* K. During the present preparation method of K, a drip formation may be the reason why K shows a larger apparent N loss than either G or I (see page 7). To avoid this unnecessary N loss, the shrimp could be stored overnight mixed with a given amount of salt and dried over a two or three day period. The endproduct could then be prepared by one single pounding during which other flavoring substances could be added.

It is thus apparent that *trasi* production might be improved in order to reduce the amount of labor and time, needed for the preparation. Furthermore the N loss during the preparation of type K might be decrased, which would increase its nutritional value.

2 **Losses during storage.**

a. *Water content.* As an approach to the effect of storage, a study was made of the changes in the water content of freshly prepared *trasi* Indramaju and in samples purchased on the local markets for Rp. 2.—, Rp. 6.— and Rp.— per ounce. The exact age, type and production place of the purchased samples were unknown. The effect of 6 months storage on the water content is presented in Table III. It may be seen that the water content varied in the initial analysis and that it decreased during storage. The longer the trasi is stored, the more water is lost. The loss of water during storage indicates that of the freshly prepared *trasi,* G looses less water than K. Of the purchased *trasi* the less expensive one lost the least water. This decrease in water content may be caused by evaporation and/or by bacterial decomposition. Because G and K are wrapped in the same way, one might expect that the water loss would be the same. Of the purchased products that of Rp. 2.— is not wrapped, while those of Rp. 6.— and Rp. 8.— are loosely wrapped in banana leaves. In these cases the loss of water is the smallest in the unwrapped trasi, which is equally unexpected.

Table III.

Average Change of Water Content in *Trasi Udang & Trasi Ikan* during Commercial Preparation.

Time change	0 month	1 month	3 month	6 month	Total loss
	% H_2O	% H_2O	% H_2O	% H_2O	% H_2O
Trasi Indramaju					
Gonjean	44.7 -0.8	44.2 -0.7	41.8 -0.9	38.7 -0.7	- 6.0 -0.1
Kundulan	45.2 -0.6	44.4 -0.6	41.8 -0.8	38.4 -0.7	- 6.8 -0.1
Trasi Purchased					
Rp. 2.—	47.1 -0.6	46.3 -0.6	44.2 -0.7	27.7 -0.7	- 9.2 -0.1
Rp. 6.—	36.9 -0.6	36.2 -0.5	33.9 -0.6	37.9 -0.7	- 9.4 -0.0
Rp. 8.—	37.9 -0.7	37.0 -0.7	34.7 -0.6	27.5 -0.6	-10.2 -0.0

b. *Nitrogen content.* The N content of the stored samples are presented in Table IV. At the starting time, it was observed that the N content varied in the different samples. At the end of the 1st month, it was obtained that the N content decreases with 0.15% in G and 0.14% in K. Thus G shows about the same loss in N as does K. Of the purchased *trasi,* the loss in N is smallest in *trasi* Rp. 2.—, the

largest in *trasi* Rp. 6.—. At the end of the 3rd month, using the fresh material, G showed a smaller loss in N than K. During this period can also be noted, that of the purchased trasi the smallest N loss is obtained in *trasi* Rp. 6.— and the largest in *trasi* Rp. 2.—. At the end of 6th month, it can be seen that in the fresh material the decrease in N for G is much smaller than in K. Of the purchased products the smallest loss in N is obtained in *trasi* Rp. 8.— and the largest loss in trasi Rp. 2.—. It may be noted that in general the total N loss is opposite to the water loss. If the decrease in N can be used as a means to determine the keeping quality, that is the less N loss the better the quality, then it can be concluded that G is better quality than K. Also can be seen that of the purchased samples, *trasi* Rp. 8.— is the best quality. In order to promote the keeping quality of K the effect of increasing amounts of flavoring agents, such as salt, sugar, etc., which are supposed to be preservatives, could be investigated. It was not ascertained wether the purchased *trasi* contained flavoring substances. Further studies on the purchased samples could be made to determine the kind, amont and effect of these materials on storage. Van Veen (1953) suggested that since purified salt is usually too expensive, inorganic impurities, usually found in crude or partially purified sea salt could also be of importance for the keeping quality. Also according to Westenberg (1941), carbohydrates (sugar, rice-pap, etc.) might have a large effect on the stability. Besides these flavoring substances, more data about the influence of storage on the N content and water loss could be obtained if the temperature, humidity, type of stored unite and the type of wrapping was also studied.
These suggested studies might lead in Indonesia to more standardized methods of *trasi* preparation, resulting in better quality products, which could keep for a longer time.

Table IV.

Influence of Storage on N Content
of Different Types of Trasi

Time change	0 month	1 month	3 month	6 month	Total loss
	% N	% N	% N	% N	% N
Trasi Indramaju					
Gonjean	9.31-0.21	9.16-0.20	8.95-0.18	8.66-0.07	-0.65-0.14
Kundulan	8.84-0.17	8.70-0.08	8.44-0.13	8.00-0.31	-0.84-0.06
Trasi Purchased					
Rp. 2.—	10.29-0.28	10.19-0.21	9.82-0.14	9.34-0.16	-0.95-0.08
Rp. 6.—	9.38-0.20	9.23-0.18	8.93-0.16	8.54-0.14	-0.84-0.14
Rp. 8.—	9.64-0.14	9.53-0.21	9.21-0.19	8.88-0.18	-0.76-0.04

SUMMARY AND CONCLUSION

A study was made of the water and nitrogen (N) content of different types of *trasi* during its commercial preparation and following storage. The types analyzed were *trasi ikan* (I), a paste made from small fish, *trasi udang* gonjean (G) and *trasi udang kundulan* (K). The latter two types are pastes prepared from shrimp. G is the product prepared in the dry season and K in the wet season. The change in water and N of *trasi* during its preparation was observed in Pengarengan anl in Indramaju. It was found that the total water loss of the fresh material was for all three types about 34%. A relatively large apparent N loss occured during the preparation of the 1st production stage. It was supposed that this was the result of the addition of flavoring substances, which affects the % N but not the N content. The total N loss during the preparation is the largest for K when compared with G and I.

During storage over 6 months, using freshly prepared *trasi* Indramaju (type G and K) and purchased *trasi* (- exact age, type and production place unknown) it was found that the water content decreases with 6-10%. The N content decreases during this period with 0.65-0.95%. Type G shows a smaller N loss than K. Of the purchased samples the least expensive product shows the largest N decrease. Proposals are made :

1. To decrease the labor and time of commercial *trasi* preparation.
2. To increase the keeping quality and standardized the commercial product.

This was believed to be of value, because of the extensive use of *trasi* in the Indonesian diet.

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